

## 4.2 Channel Stabilization

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### Definition

Improving, constructing, or stabilizing an open channel for water conveyance.

### Purpose

Open channels are constructed or stabilized to be non-erosive with no sediment deposition and to provide adequate capacity for flood water, drainage, other water management practices, or any combination thereof.



### Conditions

This standard applies to the improvement, construction, or stabilization of open channels and existing streams or ditches with drainage areas less than 1 square mile.

An adequate outlet for the modified channel length must be available for discharge by gravity flow. Construction or other improvements of the channel should not adversely affect the environmental integrity of the area and must not cause significant erosion upstream of the flooding and/or sediment deposition downstream. Channel modifications are subject to local and state regulatory requirements.

### Design Criteria

#### Planning

During the alignment and design of channels, careful consideration shall be given to the preservation of valuable fish and wildlife habitat and trees of significant value for wildlife food or shelter or for aesthetic purposes.

Where channel construction will adversely affect significant fish or wildlife habitat, mitigation measures must be included in the plan. Mitigation measures may include pools, riffles, flats, cascades, or other similar provisions.

As many trees as possible are to be left inside channel rights-of-way considering the requirements of construction, operation, and maintenance. Unusually large or beautiful trees shall be saved.

### Realignment

The realignment of channels shall be kept to an absolute minimum and should be permitted only to correct an adverse environmental condition.

### Channel Capacity

The capacity for open channels shall be determined by procedures applicable to the purposes to be served.

### Hydraulic Requirements

Manning's formula shall be used to determine velocity in channels. The "n" values for use in this formula shall be estimated using currently accepted guides along with knowledge and experience regarding the conditions. Acceptable guides can be found in hydrology textbooks.

### Channel Cross Section

The required channel cross section and grade are determined by the design capacity, the materials in which the channel is to be constructed, and the requirements for maintenance. A minimum depth may be required to provide adequate outlets for subsurface drains and tributary channels.

### Channel Stability

All channel construction, improvements, and modifications shall be in accordance with a design expected to result in a stable channel that can be maintained. Characteristics of a stable channel include:

1. The channel neither aggrades nor degrades beyond tolerable limits.
2. The channel banks do not erode to the extent that the channel cross section is changed appreciably.
3. Excessive sediment bars do not develop.
4. Excessive erosion does not occur around culverts, bridges, or elsewhere.

5. Gullies do not form or enlarge due to the entry of uncontrolled surface flow to the channel.
6. The determination of channel stability considers “bankfull” flow. Bankfull flow is defined as flow in the channel, which creates a water surface that is at or near normal ground elevation for a significant length of a channel reach. Excessive channel depth created by cutting through high ground should not be considered in determinations of bankfull flow.

#### Channel Linings and Structural Measures

Where channel velocities exceed safe velocities for vegetated lining due to increased grade or a change in channel cross section, or where durability of vegetative lining is adversely affected by seasonal changes, channel linings or rock, concrete, or other durable material may be needed. Grade stabilization structures may also be needed. Channels may be stabilized by the following methods:

##### *Rock Riprap Lining*

Rock riprap shall be designed to resist displacement when the channel is flowing at the bankfull discharge or 25-year frequency discharge, whichever is less. Dumped and machine-placed riprap should not be installed on slopes steeper than 1½ horizontal to 1 vertical.

A filter blanket of sand and/or gravel or geotextile material shall be placed between the riprap and base material. The filter blanket material shall be at least 6 inches thick with a gradation that is consistent with the base material and the riprap.

Rock shall be dense, resistant to the action of air and water, and suitable in all other respects for the purpose intended. Rock shall be installed according to applicable standards.

##### *Concrete Lining*

Concrete lining shall be designed according to currently accepted guides for structural and hydraulic adequacy. Concrete lining must be designed to carry the required discharge and to withstand the loading imposed by site conditions. Concrete lining should be considered only for extreme conditions and if approved by governing agencies. Generally, channel velocities exceeding 14 feet per second (ft/sec) may be considered for this approach.

### *Grade Stabilization Structures*

Grade stabilization structures are used to reduce or prevent excessive erosion by reducing velocities in the watercourse or by providing structures that can withstand and reduce the higher velocities. Structures may be constructed of concrete, rock, masonry, steel, aluminum, or treated wood.

These structures are constructed where the capability of earth and vegetative measures is exceeded in the safe handling of water at permissible velocities, where excessive grades or overall conditions are encountered, or where water is to be lowered structurally from one elevation to another. These structures should be planned and installed along with or as a part of other erosion control practices.

The structures must be designed hydraulically to adequately carry the channel discharge and structurally to withstand loadings imposed by the site conditions.

### **Installation Requirements**

1. When necessary, trees, brush, stumps, and other objectionable materials may be removed so they will not interfere with the construction or proper functioning of the channel.
2. Where possible, trees will be left standing and stumps will not be removed.
3. Excavation shall be at the locations and grades shown on the drawings.
4. Construction plans will specifically detail the location and handling of spoils. Spoil material resulting from clearing, grubbing, and channel excavation shall be disposed in a manner which will:
  - a. not cause an increase in flood stage,
  - b. minimize overbank wash,
  - c. not cause an adverse effect of the environmental integrity of the area,
  - d. provide for the free flow of water between the channel and flood plain unless the valley routing and water surface profile are based on continuous dikes being installed,
  - e. leave the right-of-way in the best condition possible, and
  - f. improve the aesthetic appearance of the site to the extent feasible.

5. Channel linings shall be established or installed immediately after construction or as soon as weather conditions permit.
6. Structures shall be installed according to lines and grades shown on the plans. The foundation for structures shall be cleared of all undesirable materials prior to the installation of the structures.
7. Materials used in construction shall be of permanency commensurate with the design frequency and life expectancy of the facility.
8. When used as a part of the structures, earth fill shall be placed according to the installation requirements for sediment basin embankments.
9. Construction operations shall be executed in a manner that minimizes erosion and air and water pollution. Compliance with state and local laws concerning pollution abatement shall be maintained.
10. Vegetation shall be established on all disturbed areas immediately after construction, weather permitting. If weather conditions cause a delay in establishing vegetation, the area shall be mulched in accordance with the standards for mulching. Seeding, fertilizing, and mulching shall conform to the standard for permanent vegetative cover.
11. All temporary access roads or travel ways shall be appropriately closed to exclude traffic.
12. Trees or other fallen natural vegetation not causing a deterrent to stream flow should be left for the purpose of fish habitat.
13. Construction work in the stream should be performed only after consultation with and permitting by local government and the state environmental agencies.